

PRELIMINARY REPORT ON LATE CRETACEOUS MAMMALS
FROM THE EL GALLO FORMATION,
BAJA CALIFORNIA DEL NORTE, MEXICO¹

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ABSTRACT: A preliminary study of the mammalian fossils from the late Campanian (Late Cretaceous) "El Gallo Formation" west of El Rosario, Baja California del Norte, Mexico suggests the presence of *Mesodina*, cf. *M. formosa* (Ectypodontidae, Multituberculata), ?*Styginys* sp., species probably new (Eucosmodontidae, Multituberculata), *Pedionys* sp., species probably new (Pediomyidae, Marsupialia), and a new genus of indefinite familial affinities (Insectivora). The sample provides the first knowledge of Mesozoic mammals from the west coast of North America. Despite taxonomic differences from the distant and better known mammalian local faunas of the Rocky Mountain region, the composition of the El Gallo assemblage is basically similar to taxa found in the Western Interior and does not suggest a profound endemism.

INTRODUCTION

Prior to the beginning of the present study, Mesozoic mammals from North America were unknown from rocks west of the Rocky Mountains. Field workers in the summer of 1968 under the direction of Dr. William J. Morris discovered remains of multituberculate mammals in the "El Gallo Formation," Baja California del Norte, Mexico (Fig. 1). Fossils of therian mammals were discovered in the summer of 1970 by members of another field party working under my supervision. The present paper is a preliminary report to the scientific community of these significant finds. Hopefully, future collecting and study will result in a monographic treatment of the potentially extremely important mammalian local fauna.

The "El Gallo Formation" is thought to be middle to late Campanian in age (see Morris, 1967: 1539). An unpublished potassium-argon date of approximately 73 million years is now available from a tuff in the lower one-third of the "formation" (Morris, personal communication). Although principally nonmarine in origin, a small number of marine interbeds are known. Rocks are well exposed in deeply dissected badlands and dip approximately 10° regularly to the northeast. Only a small percentage of the exposed

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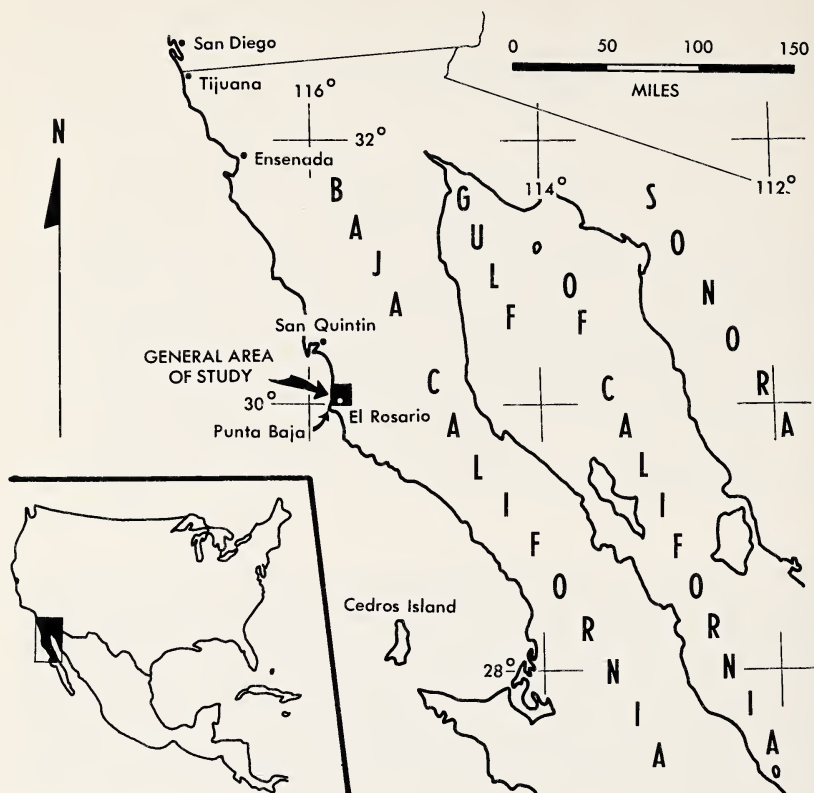


FIGURE 1. General locality maps.

area is accessible to motor vehicles. Depositional facies shift from dominantly conglomeratic near the basement source area approximately six miles to the east of the fossiliferous area to complex but generally finer clastic facies in the west. Petrified wood is common throughout. The "El Gallo Formation" was proposed by Kilmer in his unpublished Ph.D. dissertation (1963). No description or type section has ever been published, nor is the dissertation available through the microfilm services. Thus, until described in publication form, the unit must be considered informally.

LOCALITIES

Known fish-, amphibian-, lizard-, and dinosaur-bearing localities from the "El Gallo Formation" are numerous and are recorded in the files of the Vertebrate Paleontology Section, Natural History Museum of Los Angeles County. Although dinosaur bones may be expected in nearly any sedimentary

rock in the area, it is interesting and important to note that all small-vertebrate localities discovered to date are in gray to black silty claystone beds. For unknown reasons, fossils of microvertebrates are rare in the paler and coarser-textured rocks.

Fossil mammals have been discovered at three localities at various stratigraphic levels, all of which are located within the middle one-third of the formation, well above the dated tuff. Because there are no surveyed maps of the area, localities were plotted on aerial photographs and described in field notes augmented by Polaroid photos. These are also on file in the Natural History Museum of Los Angeles County. The numbers of the mammal-bearing localities are: LAV-7170, LAV-7171, LAV-7172.

METHODS

Known productive layers were quarried by breaking rocks into walnut-sized or smaller pieces while looking for freshly exposed bones. Bone-bearing clods were wrapped for later preparation in the laboratory. The others lacking exposed bones were dropped into burlap bags and carried to a soaking-tub at camp. Rocks were soaked 24 hours in kerosene, which was then siphoned off and replaced by water. The extent of breakdown of the rocks was then dramatic, for it was practically nonexistent after soaking only in water. The resultant mud was scooped into a table height large stacked screen-box system. The upper sieve was of standard gauge window screening, and the lower of 40 wires per inch bronze wire cloth. A small pump carried brackish water from a lagoon via a hose to above the mud, and gentle spraying washed away all but a concentrate of rocks and skeletal fragments. The concentrate was air dried on long burlap strips and sorted for fossils at a later time. Although considerable care to avoid breakage of the fossils was exercised through all stages of the washing process, I feel the "washing table" technique used is less desirable than others. It is necessary to scoop the fossil-bearing mud from the soaking-tub onto the screens, and even the gentlest of water spraying is damaging to small delicate bones and teeth. I feel that the quarry matrix should be soaked, washed, and dried in the same screen box and that during washing the fossil-bearing mud should be agitated gently while completely submerged in water.

All measurements (which follow the citation of individual teeth in the various "Referred or available specimens" sections) are in millimeters and were made with an EPOI Shopscope at San Diego State University using the orientations specified by Lillegraven (1969: 16). Abbreviations of measurements are as follows:

A-P	Antero-posterior length	Post-W	Posterior width
W	Greatest width	W-Tri	Width of trigonid
Ant-W	Anterior width	W-Tal	Width of talonid

The abbreviation LACM is used throughout the descriptions to indicate specimens cataloged in the Natural History Museum of Los Angeles County (Vertebrate Paleontology).

SYSTEMATIC DESCRIPTIONS

Class Mammalia

Subclass Allotheria

Order Multituberculata

Family Ectypodontidae Sloan and Van Valen, 1965
[original name emended, Van Valen and Sloan, 1966]

Genus *Mesodma* Jepsen, 1940

Mesodma, cf. *M. formosa* (Marsh), 1889b

Holotype: Yale Peabody Museum 11812, left P₄ (Marsh, 1889b, pl. 8, fig. 36-39).

Referred specimens: LACM 27588, M¹ fragment (W 1.21); LACM 27589, M² (A-P 1.33, W 1.33); LACM 27590, M₂ (A-P 1.38, W 1.26).

Localities: LAV-7170 and LAV-7171.

Distribution of Mesodma formosa: Upper part of Edmonton Formation, Alberta; Hell Creek Formation, Montana, and South Dakota; type Lance Formation, Wyoming; possibly Kirtland and Fruitland Formations, New Mexico (see list, Fassett and Hinds, 1971: 19); "El Gallo Formation," Baja California del Norte.

Comments: The three specimens here identified as *Mesodma formosa* cannot be distinguished from specimens of that taxon from Upper Cretaceous deposits of the Rocky Mountain region. The size ranges and descriptions follow closely and, until more evidence is forthcoming, I feel no new names should be defined despite the differences in ages of deposits. Because of the lack of equivalent dental elements, comparison is impossible with *M. senecia* (see Fox, 1971a).

Family Eucosmodontidae (Jepsen, 1940)

Genus *Stygimys* Sloan and Van Valen, 1965

?*Stygimys* sp.

Referred specimens: LACM 27591, M² (A-P 1.96, W 1.70) (Figure 2, A., B., C.); LACM 27592, I₁.

Localities: LAV-7170 and LAV-7172.

Distribution of genus: Hell Creek Formation, Montana; various lower and middle Paleocene localities, Rocky Mountain region; "El Gallo Formation," Baja California del Norte.

Comments: The M² here referred to ?*Stygimys* sp. (Fig. 2) is strikingly similar in overall morphology with specimens (e.g., LACM 27593) of *Stygimys kuszmauli* from the Bug Creek Anthills Local Fauna of the Hell Creek Formation, Montana (Sloan and Van Valen, 1965). However, distinct differences do exist in that the El Gallo specimen is significantly smaller than

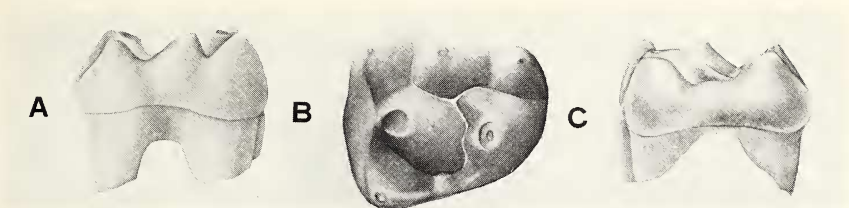


FIGURE 2. A.-C. ?*Stygimys* sp., species probably new, LACM 27591 (LAV-7170) right M²: A. lingual view; B. occlusal view; C. labial view. Approximately 13X.

the Hell Creek material (the latter are approximately A-P 2.6, W 2.3). Also, the El Gallo specimen has smoother cusp sides with much less ornamentation than the usual Hell Creek M²'s referred to *Stygimys*. The greater epi- and inter-cusp ornamentation on the Hell Creek specimens is quite possibly a specialization advanced from the primitive condition.

Additional, but admittedly weak, evidence suggesting the assignment of the M² to *Stygimys*, or at least the Taeniolabidoidea, is a fragmentary lower incisor from Locality LAV-7172 of the "El Gallo Formation" showing a distinct rodentlike eucosmodontid enamel distribution. *Stygimys* and *Catopsalis* are the only known North American Cretaceous genera possessing the eucosmodontid-type incisor enamel pattern (see Sloan and Van Valen, 1965:224). Eucosmodontid multituberculate teeth have recently been recovered from the Upper Cretaceous Kirtland and Fruitland formations of New Mexico (see list, Fassett and Hinds, 1971: 19).

Although I consider the El Gallo specimen to be distinct at least at the specific level from previously described material, I believe it would be wise to refrain from adding a new name to the taxonomic literature until a larger sample is available to allow the writing of a secure diagnosis.

Additional Multituberculate Teeth

Four other multituberculate teeth have been recovered that should be mentioned but are, in my opinion, unidentifiable generically at the present time. LACM 27594 (LAV-7172) is an isolated P³ (A-P 1.19, W 1.02) with four cusps. It resembles in basic structure the P³ of *Mesodma formosa* illustrated by Lillegraven (1969:22, Fig. 8, 2) but is proportionately shorter anteroposteriorly. Two P₄'s (LACM 27595 from LAV-7170 and 27596 from LAV-7172) are represented by the posterior halves only, and no possibility exists for making serration counts or lobe descriptions. Finally, a fragmentary questionable lower right incisor tip (LACM 27597 from LAV-7172) has been recovered. Little can be said about it except that it lacks a eucosmodontid enamel pattern but has a deep longitudinal trough along what I interpret to be the dorsolateral surface of the tooth.

Subclass Theria
Infraclass Metatheria
Order Marsupialia
Family Pedomyidae Clemens, 1966
Genus *Pediomys* Marsh, 1889a
Pediomys sp.

Only available specimen: LACM 27598, M¹ (A-P 1.67 [est.], Ant-W 1.44, Post-W 1.61) (Figure 3, A., B.).

Locality: LAV-7172.

Distribution of genus: "El Gallo Formation," Baja California del Norte; Oldman (unpublished) and Milk River formations, Alberta; Judith River Formation, Montana (in press, A. Sahni); upper part of Edmonton Formation, Alberta; Hell Creek Formation, Montana and South Dakota; Lance Formation, Wyoming; North Horn Formation, Utah; possibly Kirtland and Fruitland Formations, New Mexico (see list, Fassett and Hinds, 1971:19).

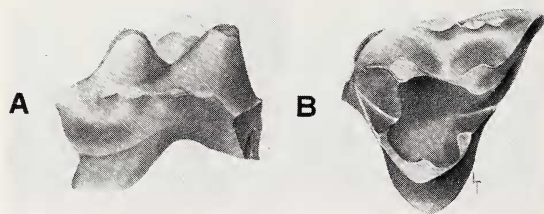


FIGURE 3. A.-B. *Pediomys* sp., species probably new, LACM 27598 (LAV-7172), left M¹: A. labial view; B. occlusal view. Approximately 17X.

Comments: The M¹ (Figure 3) almost certainly represents a heretofore undescribed small species of the genus *Pediomys*. The overall morphology most closely resembles the teeth of *P. elegans* (see Clemens, 1966), but a series of significant differences exist. The transverse measurements of LACM 27598 are proportionately less than in any other pediomyid save *P. exiguus* of the Milk River Formation of Alberta (see Fox, 1971b). As in most specimens of *P. elegans*, stylar cusp B and the stylar shelf labial to the paracone are lacking, but, in contrast, stylar cusp C in LACM 27598 is slightly larger and more robust than stylar cusp D. Stylar cusp D in LACM 27598 is long, low, and anteroposteriorly twinned, giving the appearance of beading. Wear facets are observed both on stylar cusps C and D. Unfortunately, the anterolabial corner of LACM 27598 is broken away. Lingual cingula are lacking. Details of the protocone, conules, paracone, and metacone of LACM 27598 are similar to those of the teeth of *P. elegans* (see Clemens, 1966:37). Wear facets are illustrated in Figure 3 and indicate strong shearing function along the postmetacrista in the usual therian manner. The tooth is strongly three-rooted and shows numerous differences from teeth identified as marsupial DP³'s

(e.g., Clemens, 1966, fig. 30 and Lillegraven, 1969, fig. 23, 5). I believe the tooth to be part of the molar series.

Although the size and general proportions of LACM 27598 are near those of specimens of *Pedimys exiguus*, I believe different species are represented. *P. exiguus* possesses a stylar cusp B, although reduced, usually lacks a stylar cusp C, and has an undivided bladelike stylar cusp D (Fox, 1971b:153).

I can see no serious objections to allying the species represented by LACM 27598 closely with *Pedimys elegans*. I would not unite them as the same species because significant differences in morphology, in geochronologic age, and in geographic location exist. On the other hand, the probable new species is known from only a single upper molar, and I consider it prudent to wait until the hypodigm increases before entering a new specific name into the taxonomic literature.

Infraclass Eutheria

Order Insectivora

Family indefinite

New genus

Available specimens: LACM 27599, M₂ (A-P 2.57, W-Tri 1.58, W-Tal 1.65) (Figure 4, A., B., C.); LACM 27600, mandibular fragment with talonid of M₁ (W-Tal 1.48), M₂ (A-P 2.29, W-Tri 1.50, W-Tal 1.46 [est.]), M₃ (A-P 2.43, W-Tri 1.45, W-Tal 1.33) (Figure 5, A., B., C.).

Locality: LAV-7172.

Distribution: Known only from "El Gallo Formation," Baja California del Norte.

Descriptions: LACM 27599 (Figure 4) is tentatively considered to be M₂ and is essentially unworn. The tooth is fairly robust in general construction with a moderately high crowned trigonid. The protoconid is considerably higher than the metaconid. The paraconid is low, somewhat anteriorly-projecting, and anteroposteriorly compressed. The paraconid is well separated



FIGURE 4. A.-C. Insectivora, family indefinite, new genus, LACM 27599 (LAV-7172), right M₂: A. labial view; B. occlusal view; C. lingual view. Approximately 10X.

from the metaconid and is labial to it. A short, weak cingulum is present at the anterior base of the protoconid. The talonid is slightly wider than the trigonid and the talonid cusps are well defined and separated. The talonid basin is deeply concave. The hypoconulid is close to the entoconid but cannot be strictly said to be twinned with it. The hypoconid is the highest talonid cusp, the hypoconulid the lowest. A cingulum descends steeply from the labial edge of the hypoconulid lateroventrally to the posterolabial base of the hypoconid. The cristid obliqua meets the posterior midline of the base of the protoconid.

LACM 27600 (Figure 5) is a mandibular fragment with a last molar and two preceding molars. These are tentatively identified as M_{1-3} . All three teeth are severely worn and M_1 is represented only by the posterior margin of the talonid. Cusps are distinguishable as individual units only on M_3 but the general cusp arrangement appears to have been similar to that on LACM 27599. Cingula on the available parts of all three teeth are as on LACM 27599.

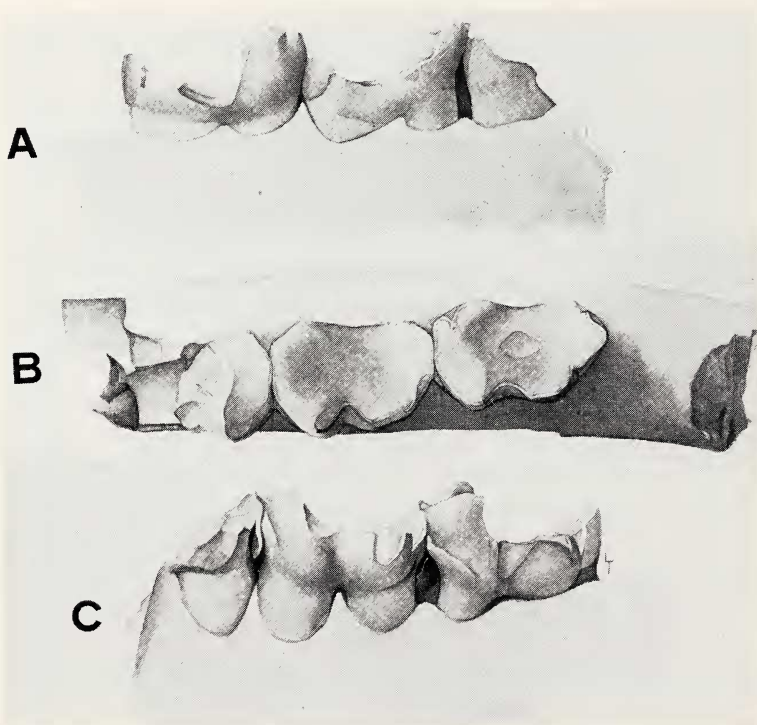


FIGURE 5. A.-C. Insectivora, family indefinite, new genus, LACM 27600 (LAV-7172), left mandibular fragment with M_{1-3} : A. lingual view; B. occlusal view; C. labial view. Approximately 9X.

The hypoconulid of the M_3 is more strongly produced posteriorly than in any other Cretaceous therian known to me, and the proportional width of the talonid of the M_3 is considerably greater than in most Cretaceous therians.

Comments: LACM 27599 and 27600 are identified as eutherian because: (1) the paraconid is proportionately small and labially placed; (2) the hypoconulid on the M_3 is strongly produced posteriorly; (3) the hypoconulid is not closely twinned with the entoconid. The combination of these features is common among placental mammals but rare among marsupials. The significance of the position of the hypoconulid (criterion "3" above) is not completely certain. As stated in the description, it is not as closely twinned with the entoconid as in most Mesozoic marsupials, yet is nearer the entoconid than in most Cretaceous eutherians yet described.

The affinity of the new species at lower categorical levels is uncertain. I placed the species in the Order Insectivora as an act of conservatism. Familial relationships are totally obscure. The specimens suggest somewhat greater similarity with molars of Late Cretaceous palaeoryctid taxa (e.g., *Cimolestes magnus*, see Lillegraven, 1969) than with other known Cretaceous groups, but evidence is insufficient to warrant even a tentative familial assignment. Considerable similarity in general form and size also exists with the "Champ-Garimond tooth" discovered in Upper Cretaceous rocks of France (Ledoux et al., 1966). The identification of that specimen, however, has also yet to be determined (see McKenna, 1969:228). No striking resemblances have been recognized with described Asiatic Cretaceous eutherians (e.g., see Kielan-Jaworowska, 1968) or the one upper molar described by Fox (1970) from the Milk River Formation of Alberta, Canada. Although a strongly developed hypoconulid on the M_3 is a feature common to most early primates, the El Gallo specimens have unusually broad and elongated talonids, paraconids well separated from the metaconids, and other features decidedly different from the most primitive known primates.

Both specimens are very tentatively referred to the same genus, and perhaps they even represent the same species. The specimens are unquestionably representative of a previously unknown genus. However, because of the scanty material at hand, I have declined to name the taxon. Despite any nomenclatorial inconvenience that may be caused, I feel it prudent to wait until adequate reference material becomes available from future field work.

DISCUSSION

The known El Gallo specimens give a tantalizing but misty first glimpse of the Late Cretaceous mammalian fauna of the West Coast of North America. Although all but one of the species discovered so far are probably new, most of the genera seem referable to those well known from the Rocky Mountain region. The El Gallo peri-Pacific Late Cretaceous collection represents ecological, geographical, and temporal settings previously unsampled. One would thus expect taxonomic differences from the distant and better known

Rocky Mountain assemblages and, indeed, they have been found. However, the known assemblage of El Gallo mammals does not suggest great and profound endemism of the Late Cretaceous fauna of Baja California. At the present stage of our knowledge, I see no particular reason to suggest geographic isolation of the peninsula from the remainder of the continent.

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RESUMEN

Un estudio preliminar de los aprovechables fósiles de mamíferos de la "formación El Gallo" del último Campaniano (último Cretáceo) al oeste de El Rosario, Baja California del Norte, México, sugiere la presencia de *Mesodma*, cf. *M. formosa* (Ectypodontidae, Multituberculata), ?*Stygmimys* sp., especie probablemente nueva (Eucosmodontidae, Multituberculata), *Pedionmys* sp., especie probablemente nueva (Pediomyidae, Marsupialia), y uno género nuevo de incierto afinidad de la familia (Insectívora). Esta muestra representa el primero conocimiento de los mamíferos de la Secundaria de la costa oeste de Norte América. A despecho de las diferencias taxonómicas de las distantes y más conocidas faunas de mamíferos de la región de Montañas Roqueñas, la composición de la colección de El Gallo es fundamentalmente semejante a taxa que es hallada an el interior del oeste y no sugiere una endemia profunda.

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